

The Mining Journal

Established 1835

Railway & Commercial Gazette

Vol. CCXLVII No. 6314

LONDON, AUGUST 24, 1956

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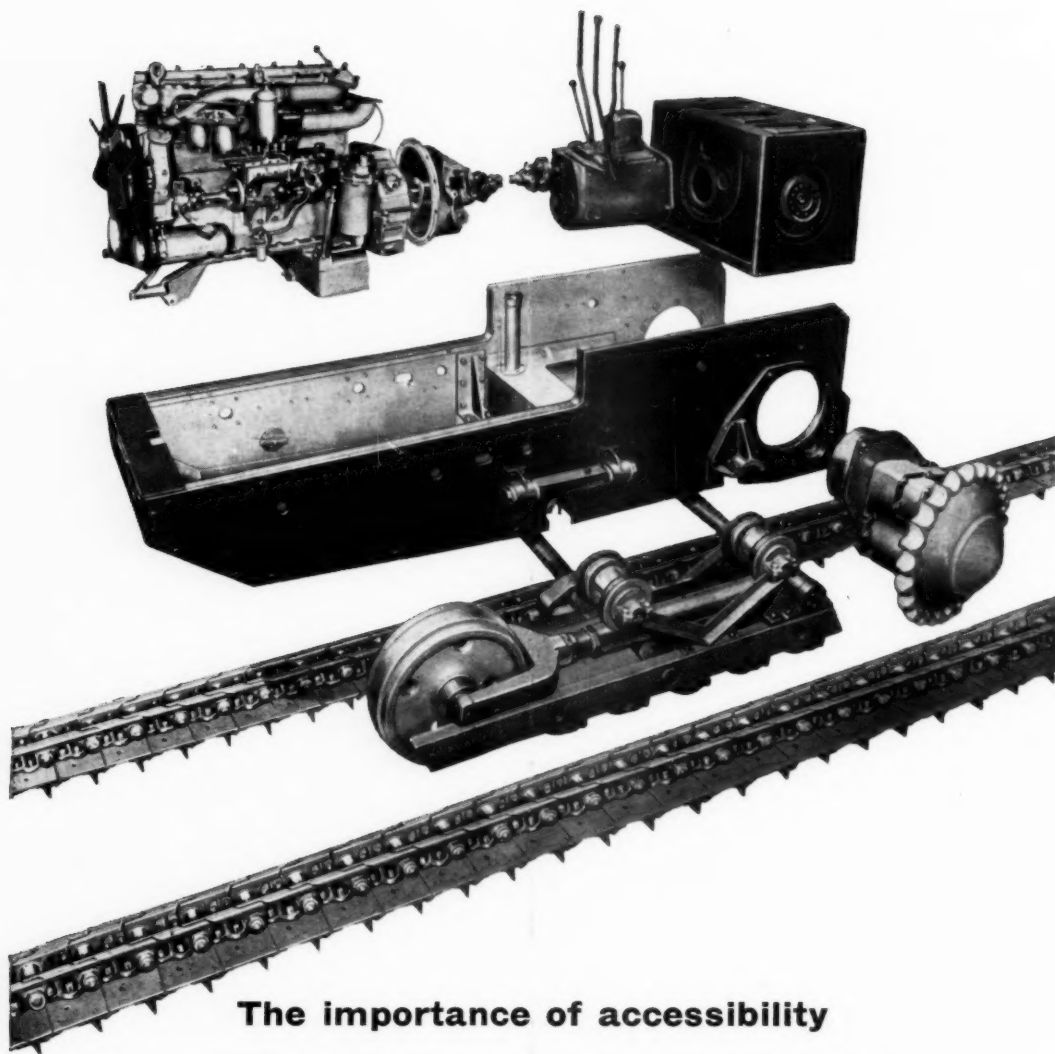


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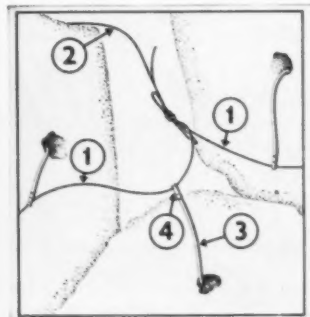
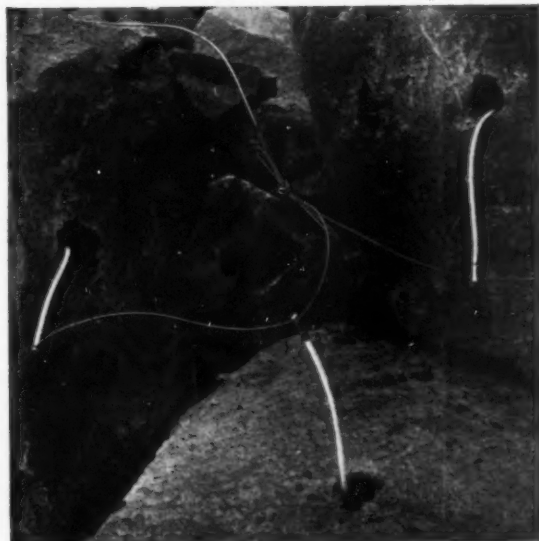
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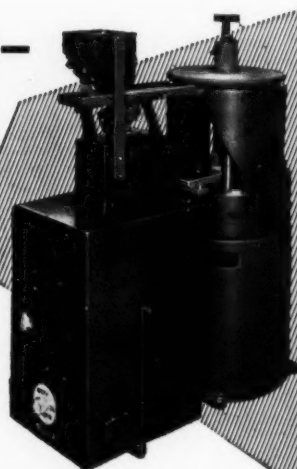
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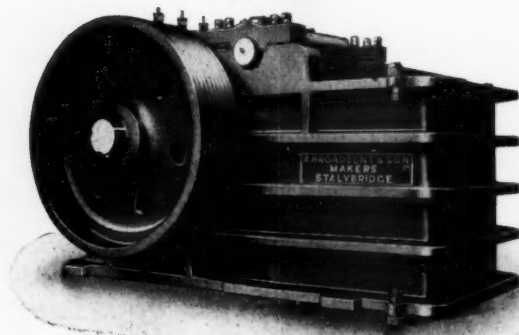
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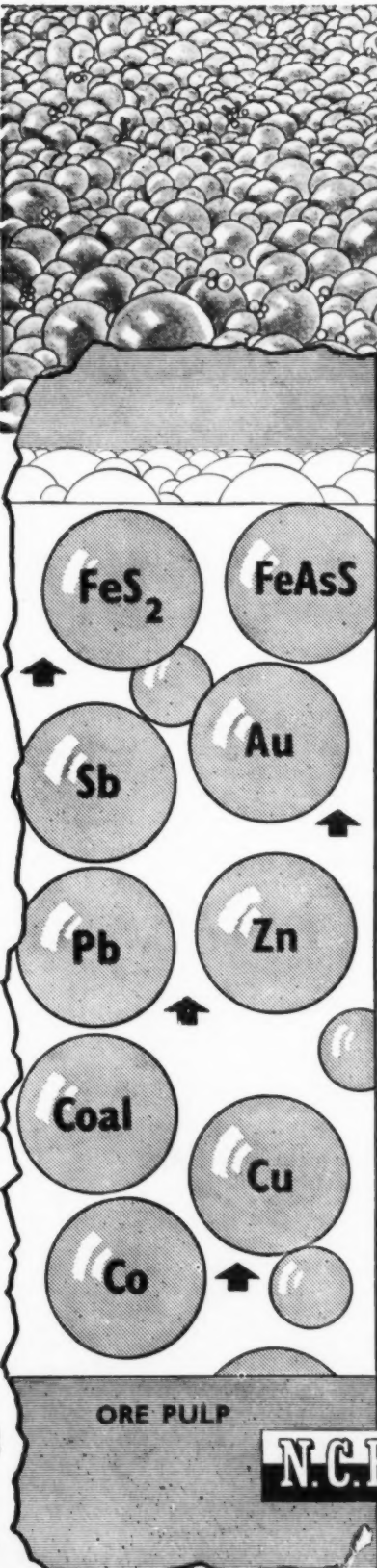
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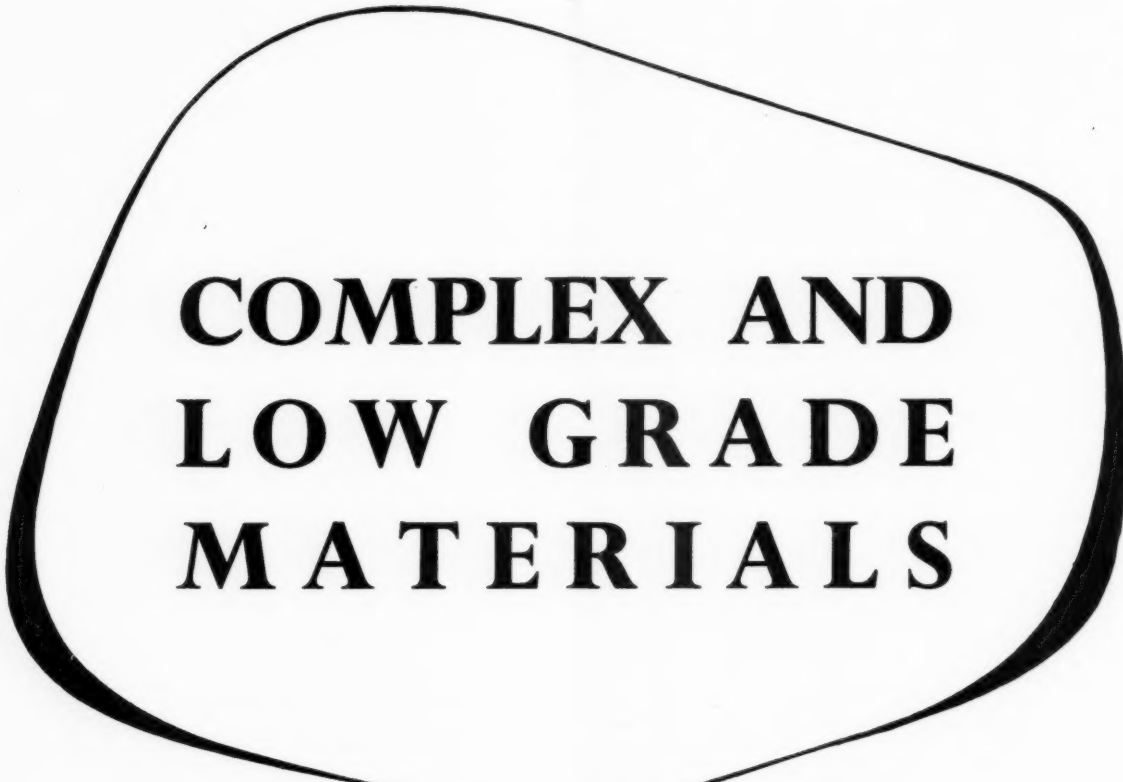
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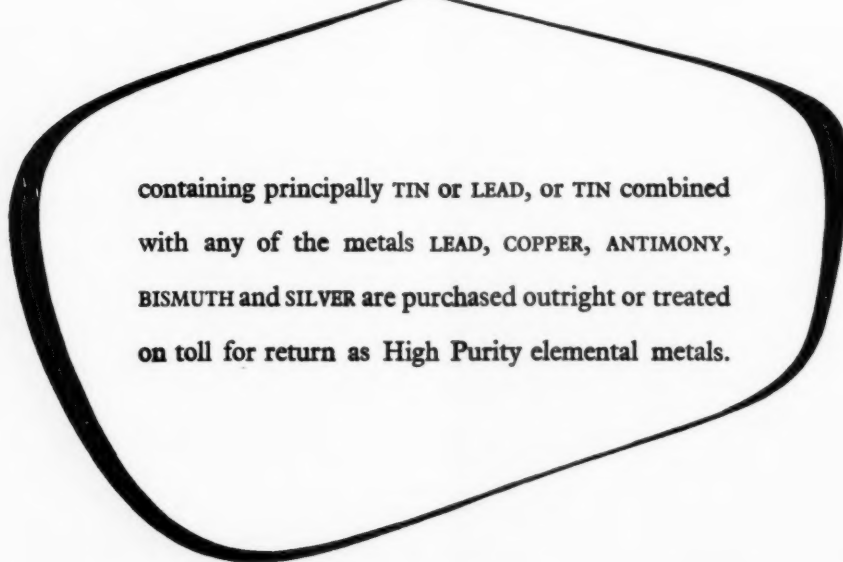
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CONTENTS

Notes and Comments	215	Recovery of Low Grade Columbium-Tantalum	221
From Our Australian Correspondent	216	Machinery and Equipment	222
Mining Development in the Middle East	217	Mining Miscellany	223
Rutile Mining in West Africa	219	Metals, Minerals and Alloys	224
Recovery of Uranium by Ion Exchange	220	Company News and Views	226

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NOTES AND COMMENTS

Australia's Untapped Mineral Wealth

At the annual meeting of the Australian Mines and Metals Association, the President, Mr. G. Lindesay Clark, made pertinent reference to existing and future conditions affecting the mining industry, as well as Australian industry.

Australia is faced with a crisis in the shortage of export income while, at the same time, internal price level is still rising and therefore adding to the difficulty in maintaining, let alone increasing, its present inadequate exports. The overriding aspect in the basic rate decisions is whether, with full or over-full employment, an increase in the basic rate will, notwithstanding the desire to do justice, defeat itself in the absence of increased production. This seems to be happening. Thus, instead of a rise bringing better conditions to a large number of people affected by the decision, will it merely be absorbed in rising prices following increased costs and by adding to inflationary forces, bring ultimate hardship and unemployment? It is evident that the Federal Court, in its recent judgment, recognized this eventuality.

Mr. Clark emphasized the great expansion in the Canadian mining industry in the past half century and the unfavourable comparison of the Australian effort. In Australia there is an immense field for prospecting around deposits already discovered. To quote an actual case, the Norseman district in Western Australia is perhaps the only field to be prospected in recent years with the intensity common in Canada. Production over the 40 years prior to 1933 amounted to 580,000 oz.; for the 22 years subsequently, 1,200,000 oz. have been produced and there is strong evidence for expecting production to continue for many years.

In base metals there are mineral provinces in Tasmania, Western New South Wales, North Queensland and the Northern Territory, and others of similarly unknown potential, in none of which has exploration been undertaken on a scale approaching that of Canada. The difference in mineral development between the two countries may quite well be much more due to the difference in the effort made to develop them than to the respective potentials.

The increased Canadian exploration effort and subsequent increased production followed and was undoubtedly greatly influenced by the enactment of favourable taxation laws. In Canada and the United States, very favourable terms of taxation have been granted to mining companies

which include a fuller recognition of the wasting asset aspect of mines as well as the financial hazards involved. A liberalization of the present laws in this respect could give a most fruitful impetus to venture capital to seek new sources of base metals. Subsidy of diamond drilling campaigns on selected projects would be one of the most effective directions in which direct aid to prospecting could be given, should governments wish to do so.

Minerals Policy in India

A number of important steps have recently been taken by the Indian government to implement its avowed intention of participating in minerals exploration and exploitation.

At the fourth meeting of the Minerals Advisory Board, held in Bangalore from June 11-14, a Minerals Transport Advisory Committee was set up to take measures, in consultation with the Railway Board, to improve the transport of minerals. Other measures taken at the same conference included the formation of four Zonal Minerals Advisory Boards to regulate programmes of exploration and development; the formulation of draft rules under Section 7 of the Minerals (Development and Regulation) Act for modifying existing leases as regards area and length of lease to conform with current procedure on new leases; and the formation of a seven member Committee to co-ordinate the work of the Bureau of Mines with departmental organizations set up by the State governments.

Further steps of major interest have since been taken. A Ministerial Committee has been formed to formulate the mineral policy with particular reference to the modification of existing leases and the constitutional procedure for determining compensation. Another notable development was the formation of a three member Oil and Natural Gas Commission which is under the chairmanship of Mr. K. D. Malaviya, Minister of Natural Resources. This commission will be in overall charge of exploration, exploitation and refining of oil in the public sector.

Particularly welcome is the active interest which is being shown by British industrialists in the extensions of heavy machinery manufactured projected under the second five year plan, in which considerable emphasis has been placed on mining plant.

Last year an agreement was signed between the government of India and Associated Electrical Industries for the

establishment of a plant for the manufacture of heavy electrical equipment in India. A.E.I. will act as technical consultants in the production of electric generators, transformers, switchgears, turbines and traction equipment. Now comes the news that the permission of the government of India is being sought by Associated Cement Companies, India, and Vickers and Babcocks and Wilcox (of Great Britain) to float a private limited liability company to undertake the manufacture in India of cement, mining machinery and water tube boilers and, with the technical assistance of David Brown, to manufacture gear-cutting machinery. Another company known as the India Steelworks Construction Company was recently formed to construct the steel works of 1,000,000 tons capacity which is to be built at Durgapur, West Bengal, at an estimated cost of £80,000,000.

The U.K. is by no means the only country interested in the opportunities afforded by India's plans for the development of heavy engineering manufacture. A Russian Mission led by Mr. B. K. Prihodiko, Vice-Minister for the heavy machine-building industry, arrived in Delhi on July 9 to advise the government on establishing a unit in the Public Sector for fabrication of certain items. There have been reports in the press that a non-official mission covering the heavy engineering field has also been offered by Japan.

The Problem of Plutonium

Most nuclear reactors produce plutonium as a by-product, but at present the only use for this material is in atomic weapons. A member of the Atomic Energy Commission, Dr. Willard F. Libby, has drawn attention to the danger that a world at peace might find itself with "enormous quantities" of deadly poisonous but commercially useless plutonium on his hands. No country has yet developed the technology of burning plutonium in nuclear furnaces to produce electric power. Dr. Libby urges chemists to work on this problem, since economical production of power from nuclear energy may depend on successful utilization of the plutonium. "It is the chemist," he stated, "who will have to tell us how to handle the plutonium in view of its extremely poisonous characteristics."

Though plutonium is not a direct product of mining and refining operations, the extent to which commercial applications can be developed for this element may have an important bearing on the future demand for uranium. The possibility of using plutonium in atomic power piles unquestionably exists, but Dr. Libby is by no means certain that convenient or cheap methods of application can be found.

Plutonium is difficult to contain in highly radioactive reactors and is extremely toxic when it gets out. Its formation could be kept down by generating power entirely from highly enriched uranium-235, such as is used in the reactors that drive atomic submarines, but this would be very costly. Most reactors use ordinary uranium-238 for producing power and this process results in large amounts of plutonium. At present plutonium is incorporated in weapons of one kind or another. One reason why electric power produced from British reactors is relatively inexpensive is because of the profitable disposal of by-product plutonium for military needs, but if atomic weapons should be banned or if stockpiling of atomic weapons were discontinued, the value of plutonium would dwindle to vanishing point.

The difficulties presented by plutonium are doubtless under consideration by the research departments of organizations associated with the development of nuclear power. The success achieved by the young atomic industry in surmounting other no less formidable problems warrants the belief that, when the need arises, this hurdle in turn will be cleared without a stumble.

Taxation and Mining in Australia

(From Our Own Correspondent)

Melbourne, August 1.

The following provisions have been introduced into the Commonwealth Income Tax and Assessment Act relating to companies, to encourage prospecting and development of the mineral industry.

Prospecting: Income derived by a company from the sale, transfer or assignment of its right to mine in a particular area of Australia or the Territory of New Guinea, for gold or certain prescribed metals and minerals is exempt (from income tax) provided the company has itself carried out the major part of the prospecting. Further dividends paid out of such exempt income are also exempt in the hands of the shareholders.

(The prescribed list covers 39 metals and minerals, but excludes lead, zinc and petroleum.)

In the case of minerals not prescribed, such as lead and zinc, the taxability on a premium, i.e., lump sums paid in cash or by instalments, paid for the grant, assignment or surrender of a mining lease, can be borne either by the vendor or the purchaser. If the purchaser assumes the responsibility the premium becomes exempt from income tax in the hands of the vendor whilst the liability is discharged by the purchaser not claiming under provisions which would otherwise apply, a sinking fund deduction in respect of the consideration paid. Where the vendor is a company such exemption is not transferable to the shareholders.

GOLD AND URANIUM

Mining: In the case of gold, income other than that from pyrite derived by the company from the working of a mining property in Australia or the Territory of New Guinea, is exempt, provided the property is worked principally for gold or gold-copper where the value of the gold is not less than 40 per cent of that of the combined gold and copper produced. Further, dividends paid out of such exempt income is exempt in the hands of shareholders. **Uranium:** Income derived by a company resident in Australia from the working of uranium-bearing ore in Australia or the Territory of New Guinea, or the concentration in Australia or New Guinea of uranium-bearing ore mined by the company, is exempt, providing that all the recovered uranium becomes the property of the Commonwealth or is disposed of to a person approved by the Commonwealth. Further, dividends paid out of such exempt income are exempt in the hands of shareholders. These provisions are limited to the income years ending June 30, 1956-1960, inclusive. **Other Prescribed Metals and Minerals:** One-fifth of the income derived by a company from mining certain specified metals and minerals in Australia is exempt. Further, dividends paid out of such exempt income are also exempt in the hands of shareholders. This provision is limited to the income years ending June 30, 1954-1960, inclusive.

Lead and zinc are excluded from the exempted list probably because their mining in Australia is carried out by strong companies, but this policy is unsatisfactory as it prevents the development of low grade lead-zinc occurrences of promise. A most important concession, and one of very great value to the advancement of the mining industry, would be the exemption from income tax of all dividends until the amount of the capital subscribed in the venture has been repaid to shareholders. This provision may, unfortunately, be as far distant as a fair price for gold.

Mining Development in the Middle East

Trends in the production, trade, finance and development programmes of Middle East countries are reviewed by the Bureau of Economic Affairs, United Nations Department of Economic and Social Affairs, in a report entitled, "Economic Developments in the Middle East, 1954-55" (H.M.S.O., 11s. stg.; \$1.50; 6.50 Sw. fr.), which brings up to date a series of annual studies by the department. Though minerals development in this region is, of course, dominated by oil, the review also indicates the growth of other branches of the mining industry.

The region designated as the "Middle East" embraces nearly 20 countries, but for some of them data on certain aspects of the economy is not available. The report is therefore concerned mainly with Egypt, Iran, Iraq, Israel, Lebanon, Syria and Turkey.

The statement made by the United Nations Economic Survey Mission which visited the area in 1949, to the effect that "the Middle East suffers from poverty in the extreme" can no longer be accepted without some qualification. In this connection a distinction should now be made between the countries which export oil and those which do not. Owing to the continuous great increase in oil production and the improved terms of payment for the producing countries, income in most of the former countries has risen regularly and markedly in recent years.

THE OIL INDUSTRY

The oil industry, which throughout the Middle East does not employ more than 150,000 people, has a cumulative invested capital in the area (including refineries and pipelines) of about \$2,600,000,000 and is now making direct contributions to governments of \$880,000,000 a year (besides indirect contributions of about \$200,000,000 a year by way of wages to employees and local purchases of goods and services). The direct contribution to the current public revenues of the major oil producing countries is large, varying from 38.3 per cent in Iran to 97 per cent in Kuwait, and some countries have elaborate plans for using their oil revenues in the interest of development. However, experience shows that the rate at which oil revenues accrue is far greater than the rate at which they can effectively be used for development. Thus, in one way or another, sometimes through official schemes and sometimes through private initiative, the oil revenues of the Persian Gulf States are gradually filtering through to other countries of the region with wider investment possibilities.

In 1954, industry appears to have made some progress in the Middle East as a whole and there are indications that the rate of progress was accelerated in 1955. Industrial development was most marked in Egypt, Israel and Turkey. The rate of expansion in the output of capital and producers' goods such as cement, steel and fertilizers, appears to have been more rapid than that of consumers' goods. Mining development was uneven: production of ores for export declined generally in 1954, while the output of minerals destined for local consumption increased.

Probably most of the investments in industry and mining, excluding petroleum, were financed from domestic sources and a large part was undertaken by governments, especially in Egypt, Iran, Iraq and Turkey. Most of the countries passed new laws—or revised existing ones—to encourage investment of foreign private capital, which had hitherto been largely confined (apart from petroleum investments) to Israel and Turkey.

INCREASED INVESTMENT IN EGYPT

In Egypt investment in industry and mining increased considerably in the two-year period under review. The National Production Council allocated the equivalent of \$36,700,000 for 1954/55 and \$55,100,000 for 1955/56 for

developing electric power, industry and mining. Private local investment, as reported by the Federation of Egyptian Industries, rose by \$8,500,000 in 1953 to \$18,000,000 in 1954. Private foreign investment was relatively small, amounting to \$2,000,000 in 1954, of which \$1,800,000 was in petroleum.

The Egyptian Government took several measures to encourage industrial expansion. Customs duties on imports of raw materials and machinery were reduced or abolished, while those on imports of competitive goods were raised. Premiums were offered for the export of minerals. Foreign exchange was made available to private investors for imports of machinery. The Industrial Bank was directed to assume a more active part in the development of industry. Laws relating to corporations and to foreign investment were revised in 1954 to improve provisions governing investment of foreign capital. The settlement in 1954 of the dispute between the Government and the oil companies over the domestic market prices of locally-produced petroleum products was followed by new petroleum concessions and an intensified search for oil by petroleum companies.

MINERALS IN 1955

Mineral development activity in 1954 and 1955 was concentrated on iron ore and petroleum. The iron ore deposits near Aswan were being brought into production to supply the ore requirements of the projected steelworks at Helwan, which was expected to come into operation in the second half of 1957. The ore is reported to have an iron content of 50 per cent; the deposit is believed to be extensive and close to the surface, ranging in thickness between 0.7 and 1.5 metres. Government exploration activities in the Sinai Peninsula resulted in the discovery of copper deposits in four areas during 1954.

Mine production in 1954 comprised 541 kg. of gold, 51,000 tonnes of manganese ore (metallic content), 527,000 tonnes of phosphate rock, and 451,000 tonnes of salt.

In Iran, industrial and mining activities, exclusive of petroleum operations) experienced a setback in 1954 and early 1955, following the appreciation of the rial, which resulted in a large increase in imports and a fall in exports of carpets and minerals. The situation appears to have improved in the latter half of 1955, following measures taken by the government to curb imports, and after financial assistance had been extended to industrial enterprises by the Bank Melli and other government agencies.

In 1954 Iran produced 155,000 tonnes of coal (150,000 tonnes in 1953), 12,000 tonnes of lead—metal content (11,000); 6,000 tonnes of manganese ore—metal content (1,000), 5,000 tonnes of zinc ore—metal content (5,000), and 10,000 tonnes of sulphur (nil).

ISING OUTPUT IN IRAQ

In 1954 and 1955, the output of most industrial products in Iraq rose. The five-year plan of 1955 allocated the equivalent of \$122,000,000 for industry. It included the construction of a bitumen refinery with a capacity of 60,000 tons of asphalt per year and two cement plants with a combined capacity of 250,000 tons of cement annually. These factories were under construction in 1955 and were

expected to be in operation before the end of 1956. A mining survey was undertaken in January, 1954, when preliminary explorations revealed the presence of large sulphur deposits, glass sands, bitumen and limestone suitable for cement production.

ISRAEL'S POTENTIAL COPPER PRODUCTION

At current prices the gross value of industrial and mining production in Israel rose from (£1)580,000,000 in 1953 to about (£1)720,000,000 in 1954, while the net value increased in the same period from (£1)219,000,000 to (£1)270,000,000. It has been officially estimated that real industrial and mining output increased by 15-20 per cent in 1954 and by 12-15 per cent in 1955.

No mine products are listed in a table showing the output of the principal industries, but a plant with an annual output of 6,570 tons of copper is being erected north of Elath, on the site of King Solomon's mines. Production is scheduled to begin by the end of 1956. In its initial phase the plant will produce cement copper which will be exported to Europe for electrolytic treatment. The next phase is to be the production of blister, and it is probable that an electrolytic process will ultimately be adopted.

A basis development plan for the exploitation of Israel's mineral resources, covering the next four years, was presented to the government by the Minister of Development in September last year. Besides completion of the copper plant near Elath, it calls for increased production of potash and the manufacture of various compounds of potash and phosphates, the expansion of the chemical industry, and exploitation of the bromide and magnesium found in the Dead Sea.

Following the introduction of improved selective mining methods and sorting plant, the Negev Phosphate Mining Company—Oron—has been supplying phosphate enriched to 28.5 per cent to the local market. The present supply of phosphates is only sufficient for the local market, but once additional equipment, planned for the near future, has been installed, Negev phosphates will become an important export commodity.

TAX RELIEF IN LEBANON

To promote industry and other activities conducive to economic development, the government of Lebanon in July, 1954, exempted new establishments with a capital of over £51,000,000 from income tax during the first six years of their operation. Other measures reduced or abolished duties on imports of machinery and raw materials, including minerals. In 1954 Lebanon produced 35,200 tonnes of non-metallic quarry products and 18,500 tonnes of metallic products.

Exploration activities in eastern Syria have led to the discovery of a natural gas field; the government expects to use it to produce electricity and supply local industry with power. A more important project was the establishment of a petroleum refinery with an annual capacity of 750,000 tonnes, to refine Iraqi crude petroleum in transit through Syria, for domestic consumption. Early in 1956, Parliament allocated \$23,000,000 for its construction and bids have been received from several foreign firms.

DEVELOPMENT IN TURKEY

The net value of Turkish industrial and mining production (at 1948 factor cost) was estimated at £T1,396,000,000 in 1954. This represents a rise of 6.5 per cent over 1953 levels and 17.2 per cent over those of 1952. The slackening in the rate of increase in 1954 was partly due to a shortage of foreign exchange for the import of raw materials and spare

TURKEY: OUTPUT OF PRINCIPAL INDUSTRIES (000's tonnes, except as indicated)

Product	1950	1952	1953	1954
Mining:				
Antimony ore (metal content) ...	1,386	928	690	713
Chrome ore (chrome content) ...	207	394	447	275
Iron ore (metal content) ...	143	305	315	371
Magnesite ...	400	900	400	1,100
Manganese ore (metal content) ...	16	39	44	24
Coal ...	4,361	4,846	5,654	5,711
Lignite ...	1,212	1,387	1,641	2,100
Lead ore (metal content) ...	100	900	4,400	6,100
Pyrites ...	—	50	55	60
Salt ...	310	323	350	481
Sulphur ...	6	8	10	10
Zinc ore (metal content) ...	—	900	4,000	5,500

parts for machines, but partial data available for 1955 indicates that the rate was again rising.

In 1954, the volume of output of some minerals, such as chrome and manganese, declined because of lower prices and exports fell because of slackening demand. Taking 1952 as 100, the index for mining production rose to 119 in 1953 and fell to 105 in 1954, at which level it was maintained in the first nine months of 1955.

The output of the principal mining products is given in the accompanying table, prepared by the Statistical Office of the United Nations.

In order to meet the increasing demand for cement for building, construction of 21 cement factories, with an output capacity of about 2,000,000 tonnes per annum, was undertaken. Three of the plants began operations in late 1955 and early 1956; 10 more were expected to begin operations in 1956. To expand the capacity of the Karabuk steel mill, £T73,400,000 was spent between 1950 and 1955. Further investment was expected to raise the annual capacity of the rolling mill to 300,000 tonnes and that of steel output to between 350,000 and 400,000 tonnes by 1956. A project was under way to construct a plant to produce 25,000 tonnes of window glass, 20,000 tonnes of soda ash and 10,000 tonnes of caustic soda per year by 1957. Another plant is under construction by the government in Kütahya to produce 60,000 tonnes of ammonium sulphate, 50,000 tonnes of ammonia nitrate, 6,000 tonnes of nitric acid and 1,000 tonnes of ammonia annually, starting in 1958.

In the field of mining, a programme to expand the annual output capacity of coal mines from 4,000,000 tonnes in 1948 to 7,000,000 tonnes in 1957 at a cost of £T381,000,000 was confirmed and £T285,000,000 had been spent by the end of 1955. Another project had been implemented to raise the yearly productive capacity of lignite mines from 1,300,000 tonnes in 1950 to 3,000,000 tonnes at a cost of £T62,000,000, of which £T46,000,000 had been invested by the end of 1955. In addition, there were substantial investments for the development of chrome, manganese, iron, copper, sulphur and other mines. Since 1950, the government has invested £T14,500,000 in prospecting for lignite, iron, wolfram, chrome, pyrite and petroleum.

JORDAN'S LACK OF CAPITAL

In Jordan, industrial and mining development continued, but lack of capital was the main factor in hampering progress. Production of phosphates was raised from 40,000 tonnes in 1953 to 80,000 tonnes in 1954 and was expected to be over 200,000 tonnes in 1955. A project was planned to expand production to 500,000 tonnes in the first stage and 2,000,000 tonnes in the second stage. Early in 1955, the Economic Council of the Arab League approved a plan for the establishment of a company in Jordan to exploit the potash resources of the Dead Sea. The establishment of a factory producing 100,000 tonnes of superphosphates annually was also considered.

Rutile Mining in West Africa

Although deposits of rutile in Sierra Leone have been investigated since 1927 and production in the French Cameroons dates from 1935, it is only recently that, following the intensive world prospecting boom for the mineral, very substantial deposits have been found along the West African coast, notably in Sierra Leone. The following article describes these deposits.

Both French and British geologists appear to be in accord with regard to the origin of the mineral in the Pre-Cambrian migmatites and complex gneisses which occur as assimilation features bordering the great tracts of granite in West Africa.

TYPES OF DEPOSITS

In the primary deposits, the rutile is contained in highly felpathic and decomposed gneisses. The decomposed state of the rock yields clay of flour-like fineness and the resemblance to china clay in some places suggests a measure of kaolinization in addition to normal weathering effects.

The rutile of the alluvial deposits is contained in the first few feet of soil or overburden and when traced, deposits may show characteristic lens shaped areas arranged *en echelon*, following the disturbed formations in which the primary deposits occur. These deposits are often of low grade and individually may only contain rutile to the order of a few thousand tons.

In the ancient marine deposits, the rutile is contained here in certain members of a series of clays and sandy clays. In Sierra Leone the series is known as the Bullom Series, which may attain thickness of 150 ft. in certain areas and is known to be rutile-bearing over a depth of at least 50 ft. in others, is characterized by the majority of members consisting of a fine grey, sandy clay, with occasional pink, freewash sands and a black lignitic clay at its base.

Very often this ancient elevated series forms a dissected plateau at an elevation of some 50-70 ft. M.S.L. and is in many respects comparable to the White Sand Series of British Guiana. In these elevated areas, a lateritic capping consisting of a dense, plastic, ferruginous clay which dries to a brick-like hardness on exposure, is often found to underlie the overburden at depths of 15 ft. or so, creating the impression of a false bedrock.

Reserves of rutile contained in deposits where this series abuts the mineralized shear zones may be estimated in terms of many millions of tons.

Alluvial deposits fall into two categories:

(a) Alluvials derived from the marine sediments. In these it is often impossible to distinguish the alluvial from the marine due to the similarity of grain size mineral content and clay content. Normally some clay and gravel members, however, serve to distinguish the two. Whilst these form local enrichments and are suitable for primitive methods of exploitation, some difficulty arises in determining the extent of the deposits:

(b) Alluvials derived from the alluvial. These deposits resemble normal alluvial gravels, usually containing pebbles of waterworn quartz and generally of shallow nature.

Since the ancient marine sediments covered a wide drainage system only remotely similar to that existing to-day, there occur, at certain points off the coast, places where the submarine contours show the base of the deposit to be elevated again, albeit not above sea level. Tidal movement and more especially regular currents tend to sweep these areas and to deposit rutile in rich concentrations at certain points. Elevation has brought some of these points above sea level where concentrations of the order of 40-50 per cent rutile are reported to cover some small islands.

West African rutile presents certain features of interest

with regard to size, grade and associated minerals. Briefly, it is possible to distinguish two main grades of fineness.

The list of minerals associated with rutile is comprehensive. Apart from such minerals as zircon and ilmenite, small quantities of monazite, tin, diamond, gold and perhaps ilmenorutile and columbite are associated with most deposits.

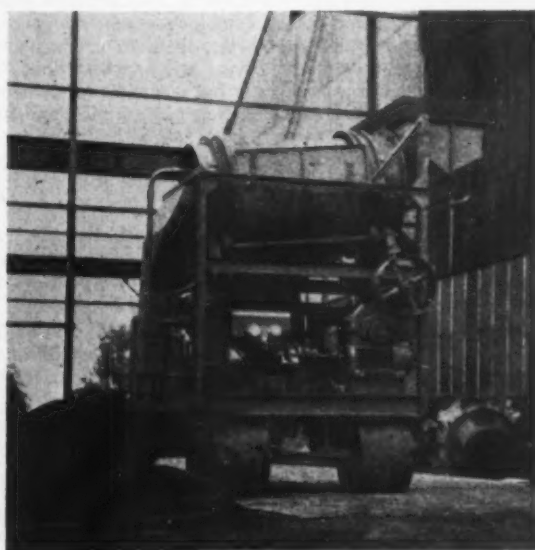
Rutile production in West Africa has up till now been only from the Cameroons. Production, which started in 1935, received a strong stimulus during the war years and production reached the peak figure of 3,320 tons in 1944. After the war, production fell substantially and although it rose again feebly in 1953, ceased entirely in 1954.

The deposits were mainly worked by regular, open cut methods, similar to alluvial gold and tin operations. Concentration, while for a long time by hand screening and jiggling, was eventually by Denver jigs on some areas in later years.

THE CENTRIFUGAL PAN

For future operations, the use of the centrifugal washing and concentrating pan, both as a prospecting tool and as a mobile treatment plant seems favoured, with larger units forming static plants.

These pans, with a rated efficiency of 98 per cent appear to provide the answer to the problem of pre-concentrating and washing the gravel before screening and jiggling and yet ensuring minimum loss, especially in the finer sizes. With the full sized 13 ft. 6 in. dia. pan able to treat some 100 cu. yd. per day, with proportionate amounts for smaller pans down to the 5 ft. trailer-mounted pan, it becomes obvious that when treating even relatively low grade deposits of, say, the order of 4 per cent rutile, some £260 worth of rutile would be recovered by each large pan in a working shift of eight hours, on a basis of to-day's price of £130 per ton.



The Fairlede Engineering mobile trommel and centrifugal washing pan ready for despatch

URANIUM RECOVERY—I

Recovery of Uranium by Ion Exchange

The application of the ion exchange technique to uranium recovery was developed jointly by a number of government and commercial organizations in various countries, among them being the Chemical Research Laboratory of the Department of Scientific and Industrial Research at Teddington, Middlesex, the Government Metallurgical Laboratory in Johannesburg, and the Massachusetts Institute of Technology. This collaborative approach to the problem of recovering uranium economically from low-grade ores has, of course, been achieved under the aegis of the Atomic Energy Research Establishment in the U.K., the U.S. Atomic Energy Commission, and their counterparts elsewhere. The following article, the first instalment of three, describes the ion exchange technique and South African extraction practice, while in subsequent issues the methods used to extract uranium from Radium Hill ores and acid pressure leaching will be discussed.

The largest use of ion exchange materials outside the field of water treatment is in the recovery and extraction of uranium from acid leach solutions. There are now more than 20 installations in various parts of the world that are producing uranium oxide on a significant scale through the medium of ion exchange.

Among the most important advantages inherent in the ion exchange method are the very great increases in the concentration of uranium in solution; i.e., the uranium concentration in the dilute acid leach is in the range of $\frac{1}{2}$ -1 gm. per litre as compared to the concentration in the ion exchange eluate of 10-20 gm. per litre. At the same time, the concentrations of other elements which normally co-precipitate with uranium in a chemical precipitation are either decreased or eliminated and are not, therefore, precipitated from the eluate with the uranium product. Thus ion exchange offers an economic means of obtaining a high-grade product directly without any up-grading steps.

The methods employed in the production of uranium from the ores now being treated were outlined by members of the U.S. Atomic Energy Commission in a paper presented at the International Conference on the Peaceful Uses of Atomic Energy, held at Geneva in 1955.¹

ACID AND ALKALINE DIGESTION

Although there are many types of minerals and ores which contain uranium, all chemical processing methods involve digestion with either acid or alkaline reagents. The choice between an acid or alkaline process depends to a great extent on the type of mineralization of the ore under consideration. Primary ores originating as pegmatites contain the uranium chemically combined with various refractory oxides such as rare earths, titanium or thorium. These refractory ores require strong acid concentrations to break down the minerals and are not amenable to alkaline leaching. Other primary ores, such as pitchblendes, and all secondary ores, are amenable to both acid and alkaline processing. Calcite, dolomite and magnesite are serious reagents in an acid process, and their presence may require an alkaline approach.

In most existing production plants acid digestion is preferred. Both nitric and hydrochloric acids are technically suitable, but sulphuric acid is more economical and is used wherever acid processing techniques are employed.

In acid digestion, conventional equipment is used throughout the uranium industry. Digestion is accomplished by one of several techniques, such as percolation leach in filter bottom tanks, and mechanical or air agitation leach. Air agitation offers the advantage of oxidation effects, but in most plants continuous leaching is used because of its greater economy. Another method sometimes employed includes pugging the ore directly with concentrated acid, which is allowed to cure for a certain period. The ore is then leached with water to extract the uranium. The various conditions of acid digestion—e.g., time, temperature, strength of acid, etc.—have an important influence on the rate and extent of uranium dissolution.

For ores containing large quantities of lime or other acid consuming constituents, the economics of acid digestion are usually unfavourable. Alkaline reagents are therefore used to extract the uranium. So far, the most useful alkaline reagent has been a mixture of sodium carbonate and sodium bicarbonate.

Chemical precipitation is more commonly used in alkaline than in acid systems. When a leaching mixture of sodium carbonate and sodium bicarbonate is employed, uranium can be recovered from a clarified leach liquor by the use of alkali to raise the pH to the point of uranium precipitation. The barren leach liquor can be regenerated by the use of CO₂. The carbonate-bicarbonate ratio can be adjusted by the addition of small quantities of sodium bicarbonate. Other methods have been investigated.

THE ION EXCHANGE TECHNIQUE

In using ion exchange resin columns the pregnant liquor must be clarified. This process utilizes modified water softening equipment, which consists of large columns containing beds of ion exchange resins. The clear pregnant solution is passed through this bed of resin until the resin is loaded with uranium. The resins most commonly employed are of the anion type and are commercially available. After the loading cycle has been completed and the bed adequately washed, the uranium is removed from the resins by the use of mixed solutions of ammonium nitrate and nitric acid. Conventional ion exchange technology is practised, modifications being made as needed to fit the peculiar characteristics of uranium adsorption and elution, and to provide for the removal of impurities. A precipitate is recovered from the eluting solution by the addition of ammonia or other basic compounds, such as magnesia.

The extraction of uranium from South African gold ores and slimes was described at the Geneva Conference by C. S. McLean and T. K. Prentice.² Before the advent of the uranium industry, the residues from the gold plants were pumped to slimes dams for storage. The solids delivered to these dams were accompanied by at least their own weight of cyanide lime solution containing some gold in solution. About one-third of the total solution was reclaimed by decantation and returned to the gold plant, where the cyanide and lime were re-used and a portion of the gold recovered.

When the extraction of uranium was introduced, it became necessary to pass the residue from the gold plant straight into the uranium plant. In order to recover some of the cyanide, lime and gold which would otherwise be lost, the gold plant residue is usually filtered in non-acid rotary filters, the gold and cyanide solution being returned to the gold plant. These filters also serve to remove as much lime and cyanide as possible from the residue before it comes into contact with sulphuric acid solution, thus reducing acid consumption in the uranium plant and eliminating the danger of generating prussic acid gas. They also remove troublesome salts.

The dewatered residue entering the uranium plant is re-

pulped with dilute sulphuric acid solution, which is the filtrate from the secondary acid filtration stage and is then pumped into large rubber-lined tanks. The use of the leaching filtrate for washing incoming ore serves to increase the value of the uranium content. The requisite amount of strong sulphuric acid is added in the tanks, together with ground manganese dioxide ore, which acts as a reducing agent. The pulp is agitated by means of compressed air for about 16 hours. For satisfactory dissolution it is necessary to have ferric sulphate present in addition to free sulphuric acid. This is obtained from the free metallic iron in the ore originating from the wearing of steel balls and cylindrical mill linings used in the grinding plant of the gold section. Dissolution is improved by heat application.

The next stage is the separation of the uranium solution from the treated slime, and for this purpose, acid resisting canvas covered rotary filters are used. However, the filtration of the pulp is difficult and a filtration acid, in the form of liquid glue, is therefore added to each agitator just before the pulp therefrom is gravitated to the primary acid filters. The use of synthetic filter-aids to take the place of, or reduce the use of, glue is at present under investigation. The filtrate from these filters is pumped to the recovery section. The residue cake, which still carries some of the dissolved uranium, is re-pulped with acidified water and is pumped to a second similar set of agitators, in which it is retained for about five hours before being gravitated to a secondary similar set of acid-resisting rotary filters. The residual cake from these filters is re-pulped and discharged to the residue dam or to a flotation plant for the recovery of pyrite before being discharged to the residue dam.

THE ION EXCHANGE COLUMNS

The uranium-bearing solution delivered to the recovery section is clarified by being passed through sand filter beds and is then passed through the ion exchange columns. These columns are usually shells 12 or more feet high and 7-8 ft. in diameter with beds about 5 ft. deep. The pregnant acid leach solution is passed through two beds in series at a retention time of 1.5 to 5 minutes or more. The second column serves to scavenge leakage of uranium ore from the first column. When the first column is exhausted and taken off stream for elution, the second column receives the pregnant solution and a third column is placed in the second or scavenger position. This rotating procedure is continued, two columns loading while the third is eluting.

The uranium and iron retained in the recovery columns are periodically removed with a solution containing a mixture of nitric acid and nitrate salts. To remove the iron from this solution the pH is raised to 3.7 by the addition of milk-of-lime. The precipitated iron hydroxide is settled in a thickener, and the underflow therefrom is filtered on a rotary filter. The cake, containing some uranium, is delivered back to the primary acid agitators for re-dissolution. The filtrate from this filter and the overflow from the thickener are then treated with ammonia and ammonium di-urate is precipitated at a pH of 6.9. This precipitate is collected in a thickener and the underflow therefrom is filtered to give the final product containing the uranium output. The filtrate from this filter and the overflow from the thickener are brought back to nitrate strength and re-used to extract uranium from the recovery columns.

The final product, ammonium di-urate $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$, is despatched in a wet form to a central calcining works.

REFERENCES

- (1) *Recovery of Uranium from its Ores*, by G. Marvin, T. Upchurch, E. Greenleaf, E. Van Blarcom and A. Morphew.
- (2) *The South African Uranium Industry*, by C. S. McLean and T. K. Prentice.

Recovery of Low Grade Columbium-Tantalum

Tantalum and columbite, which hitherto have been obtainable only through costly processes, can now be recovered from ores, concentrates and smelter slags by a revolutionary process evolved by the U.S. Bureau of Mines. Several companies in the U.S. and overseas are already preparing to use this process on a commercial scale.

A report describing the new process has been prepared by Kenneth B. Higbie and Joseph R. Werning after two years of research. Entitled "Separation of Tantalum-Columbite by Solvent Extraction," it is numbered R11.5239 and may be obtained from the Bureau of Mines, Publications Section, 4800 Forbes Street, Pittsburgh, Pa.

Tantalum is used chiefly in electronic and corrosion-resistant equipment. Columbium is an essential constituent of special high-temperature alloy employed in jet planes and guided missiles. These critically important metals occur together, and are chemically so much alike that for 100 years separating them has been one of chemistry's most difficult problems. The method commonly used to-day, a modification of one first suggested nearly a century ago, can be used economically only with high-grade ores or concentrates. The new process is more efficient and promises to enable industry to utilize low-grade materials.

On a laboratory scale, the investigators experimented with some 200 combinations of various organic solvents and mineral acids for separating columbium from tantalum by a technique known as liquid-liquid extraction.

In this method, the valuable metals in the feed material are first dissolved in a water-based solution. To this is added a second solution, usually an organic solvent, which, like oil in water, will not mix. When the two are churned or shaken together, the organic solvent extracts one of the metals, leaving the others.

PROCESS FEASIBLE FOR INDUSTRIAL USE

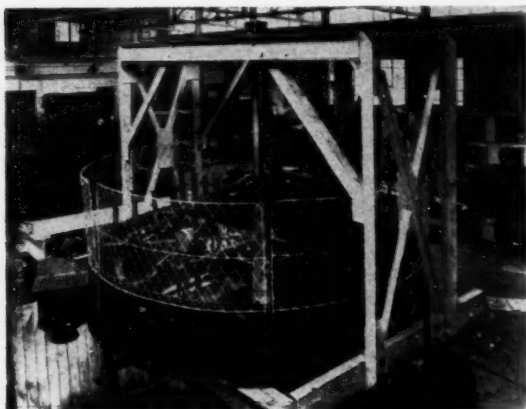
From the 200 combinations studied, two were selected for extensive laboratory tests. In the more promising of the two, mixed metals were dissolved in a solution of hydrofluoric acid and hydrochloric acid and then contacted with methyl isobutyl ketone. The methyl isobutyl ketone extracted the tantalum, leaving the columbium in the acid solution.

Subsequent separate treatment of the two solutions yielded both columbium and tantalum oxides of better than 99 per cent purity; recovering the metals from these presents no special problem. The report states that the process appears feasible for industrial use, is suitable for treating low-grade concentrates, and is effective, regardless of the columbium-tantalum ratio of the feed material. Publication of the Bureau of Mines report coincided with an announcement that Fansteel Metallurgical Corporation plans to build a new \$6,000,000 plant for the production of tantalum and columbium metal, which is designed to increase present tantalum capacity by 50 per cent and present columbium capacity by 150 per cent. The corporation's present plant at North Chicago, Ill., including a \$1,000,000 expansion authorized in 1955 and now being completed, cannot cope with the rapidly growing demand for these metals. Dr. Frank H. Driggs, president of Fansteel, states that the constantly increasing fields of applications for tantalum capacitors, coupled with the other tantalum uses and the growing requirements for columbium for experimental work in nuclear reactors, indicate that immediate steps must be taken to anticipate future requirements for these metals.

MACHINERY AND EQUIPMENT

Ore Processing Control by Gamma Ray

At Pronto Uranium Mines, in Canada's Blind River district, Isotope Product's Density Gammagage controls overflow of crushed ore from the classifiers. At another uranium mill, a Gammagage controls ore dust in a reactor tower. An iron mine employs Gammagage control on a high grade ore circuit. For a rare metals producer Isotope Products is building an elaborate four-unit Gammagage to control grinding and classifier circuits.



The Density Gammagage

More than half a dozen applications of the Density Gammagage have been developed by Isotope Products engineers in conjunction with the mining industry.

The Gammagage consists of an isotope source which beams penetrating gamma rays through a pipe or vessel wall, an ionization chamber and a detector unit which records the gamma rays which pass through. Electronic equipment converts the effect of the gamma rays on the detector to an electrical signal. This signal, in turn, is applied to actuate automatic controls.

Typical is a grinding circuit installation, illustrated above, where three Gammagages respectively regulate raw feed, circulating load and classifier overflow. The first instrument controls feed from ore bins by adjusting the speed of the feeders. The instrument measures the ore plus a constant amount of water. A second Gammagage monitors the circulating load before it reaches the ball mill. Encountering a run of softer ore which requires less grinding, it increases the feed to keep the ball mill at maximum capacity. The third Gammagage controls final circuit output, measuring the density of the classifier overflow and regulating the amount of dilution water added.

Successful Canadian "EM" Equipment

A Canadian-developed mineral-hunting device which has been responsible in little over a year's operation for discovering millions of dollars worth of exploitable sulphide ores in New Brunswick is being exported for use throughout Europe, Africa and Australia. It will be recalled that this device was mentioned briefly in our report on Operation Overthrust published in *The Mining Journal* of August 17, 1956.

The airborne electromagnetometer or EM

developed by Aeromagnetic Surveys Ltd., of Toronto, is now ready for use by the Toronto company's English associate, Hunting Geophysics Ltd., throughout the United Kingdom, Europe and Africa. Another EM installation is being flown to Australia for use there by another associate, Adastra Airways (Pty.) Ltd., of Sydney. A variation of this EM equipment for use by a helicopter in precipitous areas inaccessible to a fixed-wing aircraft has also been introduced by Aeromagnetic Surveys, Ltd.

Hunting Geophysics has installed the Canadian EM equipment in a specially-fitted Dakota aircraft. Like the first Canadian installation in a Canso amphibian, the installation in the Dakota has been arranged to include a magnetometer and scintillation counter as well. The EM bird towed at the end of 500 ft. of cable detects nickel, copper or zinc sulphides. The magnetometer projecting from the Dakota's and Canso's tail helps geologists to plot likely deposits of iron, oil and titanium. The scintillation counter in the belly of the fuselage of both aircraft reacts to radio-active ores.

A Surface Handling Plant

The Fraser and Chalmers Engineering Works of The General Electric Co. Ltd., has received a contract from the National Coal Board for a comprehensive surface handling plant for installation at Lea Hall Colliery, now in course of construction in the Cannock Chase Area of the West Midlands Division.

The conveying equipment will be designed initially to handle coal and dirt from both shafts at a rated capacity of 600 tons an hour.

Equipment will be designed to convey dirt and coal from both upcast and downcast shafts as may be necessary. It includes the supply of mine car tipplers and apron plate feeders delivering dirt to belts conveying to grizzly screens, the oversize being reduced by a jaw crusher before delivery to a dirt surge bunker for ultimate disposal. Coal will be delivered by belt conveyors through Gyrex screens and crushers for distribution to blending bunkers.

A side-discharge 35-ton capacity wagon tippler will feed imported coal into the conveying system for delivery to the blending bunkers where, together with output from Lea Hall Colliery, it will be discharged into a receiving hopper to supply the adjacent Rugeley Generating Station of the Central Electricity Authority.

Higher grade coal will be treated in the proposed preparation plant. The contract is reported as being valued at approximately £250,000.



An underground haulage way at Mid-Cannock Colliery in the Cannock Chase area

MINING MISCELLANY

German technicians have arrived in Llata (northern Peru) to operate coal mines owned by Incanadium S.A.

A team of iron and coal experts from "Wedexro" (West Germany) are surveying coal deposits at Kota Baru, South East Borneo.

Exploitation of two sources of gold, and manganese, and copper, is likely to be resumed shortly in the Province of Catamarca, Argentina.

The whole of the first year's production of lead ore from the Mestersvig mines in Greenland, now said to be about 7,000 tons, has been sold to Belgium. Next year's production is expected to reach about 18,000 tons.

The search for uranium in South Greenland has been resumed. Samples of rock analysed have shown the possibility of the presence of both uranium and thorium.

It is expected that this year exports of iron ore from Peru will reach about 2,000,000 tonnes or about double the previous year's exports. This expansion is due almost entirely to increased shipments from the Marcona mines in the south.

Machinery and equipment worth 10,460,000 rupees has been ordered for open-cast mining and in the Neyveli lignite project in the South Arcot district of Madras. The project envisages the mining of 3,500,000 tons of lignite a year.

Four new mines will shortly be opened by Union Minière in Haut Katanga, Belgian Congo. Two of these are for cobalt and are situated just north of Kolwezi and west of Jadotville. A copper mine is being opened at Lumembi and a lead mine near Tchisenda.

The discovery has been announced of a rich gold vein in the El Dorado Gold Mines in the West Caburi region of British Guiana. The area has been worked on several occasions without success. Although the quartz carries very high values, it is not yet possible to estimate the extent of the deposit.

A Malay-Japanese concern, the Eastern Mineral Trading Company, has been offered a loan of 500,000 Malayan dollars (£58,400) by Japanese investors. The company's capital of 250,000 Malayan dollars, which has been fully subscribed, was found to be inadequate to start large-scale mining operations.

At the annual meeting of the Belcher Mining Corporation, the president, Mr. D. Banks, said that exploration on the company's claims on Innetalling Island, Hudson's Bay, had outlined what appeared to be the largest single deposit of magnetite ore anywhere in the world.

The Nikodije Stojanovic Tatko factory at Prokuplje, Yugoslavia, which produces felt and asbestos products, has manufactured the first yarn from domestic fibre obtained from the Rujiste Mines near Kosovska Mitrovica. Hitherto the industry has used only imported asbestos.

The Japanese Government will shortly approve the establishment of a joint mining company by two Japanese companies, the Mitsubishi Trading Co. and the Mitsubishi Mining Co., to develop the Inicia Tiva mine in Peru which is owned by the Perulex Co. Japanese experts are being dispatched to Peru to conduct a survey of the undeveloped mine, which is claimed to hold 20,000,000 tons of iron ore.

Rye Park Scheelite's treatment plant at Laurietown, New South Wales, now has a rated capacity of about 150 tons of rutile per week. Speaking at the company's annual meeting, the chairman gave the profits from rutile operations in the seven months to end-June this year at £A30,015 and said it was estimated that when operations had been stepped up to capacity, profits would be in the region of £A250,000 annually. He added that the Laurietown deposits contained 30,000 tons of clean zircon. Rutile production, however, would be brought up to capacity first.

The first dividend of National Mineral Holdings Ltd. (miners of beach sands at Wollongong and Newcastle, New South Wales) as a public company is equivalent to an annual rate of 75 per cent. The company and its subsidiaries made a profit of £A140,047 for the year to end-June and the directors

declared a dividend of 1s. 3d. per 5s. share tax-free for the four months from incorporation on February 23 to June 30.

A grant of nearly \$1,750,000 has been made by the Colonial Development and Welfare Fund to enable the Geological Survey Department of British Guiana to continue its programme with the object of intensive mineral development. There will be two main objectives, the first being continuation of the Banka drilling project for alluvial minerals and examination of all known gold mines, and the second a general survey, by a team of geologists, over the whole of the virgin country in the Rupununi district.

PERSONAL

Metropolitan-Vickers Electrical Export Co. has appointed Mr. D. R. Love to be manager, Dominions Division.

Sir George Turner has been appointed a director of the Goodyear Tyre and Rubber Co. (Great Britain).

The Rio Tinto Co., Ltd., has appointed Mr. James Anthony Clay as economic adviser. Mr. Clay, a Chartered Accountant, is a son of the late Sir Henry Clay, the well-known economist.

Mr. J. R. Wingfield has been appointed a director of Huntington, Heberlein & Co. Ltd. (subsidiary of Simon-Carves Ltd.). He retains his position as company secretary.

Mr. J. Dee Shapland has been appointed to the board of Foamite Ltd. as technical director. He has also been appointed chief chemical engineer to the parent company, Tecaemit Ltd.

The address of the London Office of the Cementation Co. Ltd. has been changed to P.O. Box 151, 20 Albert Embankment, London, S.E.11. Telephone Reliance 7654.

Mr. Campbell Richard Witcher has been appointed a director of Consolidated Tin Mines of Burma Ltd. in succession to the late Mr. P. E. Day. Mr. R. J. Martin has been appointed secretary in succession to Mr. Day.

Mr. Arthur Klages, sales manager of the Titanium Corporation (Australia) Pty. is visiting Britain and Western Europe to arrange forward contract sales with potential customers for rutile and associated minerals.

Mr. H. Clifford Williams has been appointed representative of the Mechanical Handling and Colliery Engineering Division of Humphreys and Glasgow Ltd. within the South Western Division of the National Coal Board. His address is 15 Tydraw Road, Roath Park, Cardiff (Telephone, Cardiff 46918).

CONTRACTS AND TENDERS

Requests for equipment received by the Technical Assistance Board of the United Nations during the period July 1-31, 1956, include drilling equipment for mineral resources development in Jordan (TAB request symbol JOR-66). Firms interested should write to the United Nations Technical Assistance Administration (UNTAA), New York. B.O.T. Ref., E.S.B./2201/56. Telephone: Chancery 4411, extension 693.

Jeffrey Gallion and Robins Conveyors, both of Johannesburg, have been awarded a contract worth £650,000 for the supply of mechanical conveyors to the Nchanga Consolidated Copper Mines, Northern Rhodesia. Over 90 per cent of the plant will be fabricated in the Union, largely from South African materials.

Simon-Carves (Australia) Pty. has begun construction of an acid plant at Rum Jungle, in the Northern Territory, for Territory Enterprises, which will more than treble the present acid-making capacity at Rum Jungle.

Patel Mavji Kanji and Bros., Jail Gate Road, Rajkot, Saurashtra, wish to contact U.K. manufacturers of belt conveyors and mechanized handling equipment. They wish to enter into trading arrangements on the basis of eventual part or total manufacture in India in collaboration with U.K. firms. Manufacturers interested should write direct to the Rajkot firm, at the same time notifying the U.K. Trade Commissioner, P.O. Box 815, Mercantile Bank Building, Mahatma Gandhi Road, Bombay No. 1. B.O.T. Ref., ESB/18279/56. Telephone, Chancery 4411, Extension 776.

METALS, MINERALS AND ALLOYS

COPPER.—Copper has eased slightly in the United States. The big producers are still quoting 40 c. per lb. but the custom smelters have lowered their price by $\frac{1}{4}$ c. to 39 c. and the price of No. 2 scrap has declined to 32 c. Latterly dealers were offering the metal at 38 $\frac{1}{2}$ c. a lb.

One fundamental reason for the easiness is the more optimistic view taken of the Suez crisis. Another is the excess of production over the current rate of offtake and the consequent build-up in stocks in the hands of producers. Yet the weakness is not too pronounced. The custom smelters are still a couple of cents above their lowest price of the year and are clinging as hard as they can to the big producers. For there are more hopeful signs. Brass mills are now fairly confident that their fortunes have changed. Orders are perceptibly improving if there is no flood of buying; and the fact that deliveries are requested for as little as two weeks suggests that consumers have cut their inventories well down. *Wall Street Journal* suggests another reason—that there is distinct possibility of a strike at the Garfield refinery of American Smelting and Refining, which handles about 21,000 tons of refined copper a month. Finally, and at the back of the brass mills' optimism, is the belief that the automobile industry will shortly pick up when manufacture of the new models starts.

Meanwhile in Northern Rhodesia the strike at Mufulira has ended and another has broken out at Nchanga. Mr. Nkoloma, secretary of the Mineworkers' Union, said that these sporadic protest strikes would continue indefinitely until the union was "free to represent whom it wished".

LEAD.—Lead has had a good week with the New York price very firm at 16 c. per lb. There has been a good all round demand although the battery makers who are now beginning to work up to their seasonal climax are well in the van. Some of the demand is insistent; that is metal is wanted in a week or two which suggests that customers are not too well stocked. Furthermore, there has been continued buying on a fixed price basis. This is too early to say whether the market is preparing for a rise which is what this sort of buying normally indicates. Probably a fair part of current demand is precautionary. Battery making is quite seasonal and if the normal seasonal peak were to coincide with a recovery in automobiles then a really sharp demand might spring up. Meanwhile the protectionist plank that has been written into the platform of the Democratic party is worth noting. Some will say that this time it does not matter what is in the Democrats platform, but when the Democrats start turning protectionist it becomes a little hard to know where to look for trade liberals.

TIN.—Tin eased more than £8 in two days in London following the news that the Malayan strike would not take place although it later advanced again, but in New York the movement was less pronounced and spot straits metal soon climbed back to 99.37 c. per lb. Yet in neither market was the swing as great as this news could normally expect to create. The chief reason for this fact was that markets believed the employers when they repeatedly asserted that the strike could never take place. The turning point came when it was clear that the union could not expect help from the government. The government refused to intervene on the union's part and later refused to ask the employers not to use non-union labour in return from a promise by the union not to withdraw safety crews from the dredges. It appears that members of the International Confederation of Free Trade Unions mediated in the dispute and as a result the union agreed to recognize the employers' association again for bargaining purposes and both sides agreed to submit the claim for back pay to the industrial court. A strike of about 2,000 miners employed by the Pahang Consolidated Tin mine in the Kuantan area, on the day following the settlement, was called off after 24 hours and the union's insistence that the dispute should be settled by negotiation suggests that it is now in a more conciliatory mood. There was another reason why the settlement of the dispute did not have a great effect on the market—and that was the fact that as a market factor it was nowhere near so important as the Suez dispute. The Suez crisis is not much further advanced as a market factor—that is to say that we are still in the talking stage.

Meanwhile in Nigeria representatives of employers and union are meeting at Jos to try to settle the dispute which threatened to produce a strike earlier this month.

The Texas smelter is now back in normal working order after being idle throughout July because of lack of concentrates. The lack was due to a hiatus in buying when it appeared possible that the smelter would be closed on June 30 of this year. It is understood that the smelter is now back at the average rate it has maintained throughout the first six months of 1956.

World output of tin in concentrates in June was 14,500 tons, the same as in May. Output rose in Indonesia to 2,653 tons, in the Congo to 1,152 tons, and in Thailand to 932 tons; in Malaya output fell to 5,287 tons, and in Bolivia to 2,186 tons. In the first half of 1956 world mine output was 83,700 tons against 176,000 tons in the whole of 1955. Stocks of tin at the end of June were 8,000 tons in the U.K., 6,000 tons in Malaya and 3,926 tons in Indonesia.

ZINC.—Zinc has been quietly steady in the past week with the price unchanged at 13.30 c. per lb. East St. Louis for prime western grade. An occasional order for prime western has raised hopes that the galvanizers were coming back to the market in strength after the steel strike and a sizeable order for special high-grade has suggested that the automobile industry was beginning to pick up. But the fact is that although a lot has been hopefully read into trading there is nothing yet to indicate that a real discovery in buying is at hand. All hopes must now be pinned on Detroit and in about a month automobile makers should step up their buying appreciably if the hoped-for revival is to come with the new models. However, the brass mills are certainly increasing their buying. The trouble is that no conceivable buying by the brass mills can make any sort of a hole in the stocks that producers built up during the steel strike; only Detroit and the galvanizers can do that.

ALUMINIUM.—Further plans for the expansion of primary aluminium production in America, Europe and Africa have recently been reported. In the U.S., Revere Copper and Brass Inc. is said to be discussing plans with Olin Mathieson Chemical Co. for a joint venture. Revere, the country's largest independent fabricator of copper and brass, is also one of the more important fabricators of aluminium. It is understood that Olin Mathieson is considering an increase in the projected size of its primary aluminium plant, which is scheduled for completion in 1958. Located at Omal, Ohio, this plant will have an initial annual output of 60,000 tons of ingot. An adjoining alumina plant will have a capacity of 230,000 tons yearly—twice the amount needed to supply raw material for the production of 60,000 tons of primary aluminium. Reynolds has plans for construction of a new reduction plant on a 7,000-acre tract east of the new Grass River lock of the St. Lawrence Seaway development and north-east of Massena. Formal announcement of the selection of the site is likely to be withheld until favourable action is taken by the Power Authority of the State of New York on a proposed tentative 200,000 kW. power contract.

Kaiser Bauxite is planning a \$30,000,000 (£10,700,000) development programme for the north coast of Jamaica with Discovery Bay—where Columbus landed in 1494—as a bauxite shipping centre.

The Soviet Union and East Germany, under an agreement signed in Moscow on August 3, are giving Yugoslavia a joint loan of 700,000,000 roubles (\$175,000,000) to develop her aluminium industry. Yugoslavia will use the loan to begin construction this year of a plant which is scheduled to yield 100,000 tons of aluminium annually in the first phase, which will be completed by 1961. The Soviet Union and East Germany will give further credits for subsequent phases, details of which will be negotiated later. The loan will be "long term" and will bear interest at the rate of 2 per cent per annum.

A Belgian aluminium syndicate has been formed with a capital of 250,000,000 Belgian francs. It will investigate, *inter alia*, the possibilities of establishing an electrolytic plant in the lower Congo in close co-operation with the Government's hydro-electric scheme in that area. Members of the syndicate include the Société Générale de Belgique, Union Minière, Société Industrielle de l'Aluminium and several colonial groups, as well as Electrobél and the Banque de Paris et des Pays Bas.

Initial production of metal from the \$37,000,000 aluminium plant under construction at Edea in the Cameroons is now scheduled for December. Operation at the full planned capacity of 45,000 tons of ingot and plate, however, is not expected before mid-1958. Construction has been under way since 1955, when the Compagnie de l'Aluminium Pechiney-Ugine was organized to build and operate the plant.

India plans to produce 40,000 tons of aluminium annually compared with the current rate of 7,500 tons. The State-controlled National Industrial Development Board has taken the initiative in setting up two plants, one at Mettur in Madras State and one in the Rihand power project area in the State of Uttar Pradesh. Both plants will probably cost between 100,000,000 and 120,000,000 rupees. One will go into pro-

duction during the second Five-Year Plan (1956-61) and the other is scheduled for completion early in 1962. In addition, the Government of India has given the Indian Aluminium Company permission to set up a 10,000 ton per year reduction plant at Hirakud in Orissa State in collaboration with Aluminium Laboratories of Montreal, Canada, while plans have been announced to double the output of the Jaykaynagar aluminium plant in Uttar Pradesh, which produces 2,500,000 tons per year. To provide the raw materials for this expanded output, it is foreseen that India's bauxite production under the Five-Year Plan will be raised to 175,000 tons from the current level of 75,000 tons.

CHROME.—Local press reports indicate that enquiries for Turkish chrome ore have been received from the U.S. with offers for the highest-grade material in the region of \$55 per tonne. It is pointed out, however, that costs will preclude the conclusion of contracts at this price level. Transport from mine to railhead alone is said to cost £T20 per ton, while rail transport to the port costs £T60 per ton, which already gives a combined domestic transport cost equivalent to \$U.S.27. The report suggest that a Mining Bank be set up to provide the necessary credits to help solve these problems, but add that, for the time being, no solution can be found in view of the necessity to move the harvests.

COBALT.—A Cobalt Information Centre has been established at the Battelle Institute, Columbus, Ohio. Its purpose is to encourage cobalt research and to provide technical and economic information for users in the metallurgical, chemical, ceramics, electronics, pharmaceutical and nucleonics industries.

LITHIUM.—Dominium Magnesium Ltd. is to produce lithium at its Haley plant. This will be the first time that lithium in a metallic form has been produced in Canada on a production basis. Lithium, as a basis for lithium hydride, is used as a fuel for guided missiles, and it also has important commercial applications (e.g., for heat-treating steel, for de-oxidizing copper, and for alloying with other metals). The company is confident that existing markets in Britain and the U.S. will be expanded and the use of lithium in industry greatly increased.

MAGNESIUM.—The Dow Chemical Co. has announced higher prices for its magnesium and magnesium products, following settlement of a four-week strike at the two Texas plants, which ended on August 10. The price increases, effective from August 13, amount to 1½ c. a lb. on primary, pig and ingot. Most wrought products are up by about 5 per cent. Pig and ingot are now quoted at 35½ c. a lb. respectively, both f.o.b. Velasco, Texas.

An important new outlet for magnesium is indicated by the news that Dow has developed a magnesium-thorium alloy which can be used in high temperature aircraft development projects. The company reported that the alloy could be delivered in production quantities. It is the first of a series of magnesium alloys containing thorium, zirconium and manganese for high temperature work. Because of its light weight the new alloy can be used in thicker sections than heavier metals. It is claimed to have excellent corrosion resistance.

The 12th annual convention of the Magnesium Association is to be held at Chicago on October 4 and 5. It is open to all who have any interest in magnesium. One of its features will be an address by Mr. J. P. Walsh, deputy director of Project Vanguard, discussing the selection of magnesium for the skin of the outer space satellite to be launched next year.

ZIRCONIUM.—Zirconium and titanium plants are being placed in operation this month in Oregon, U.S., by the newly-formed Oregon Metallurgical Corporation. The plant will produce titanium and zirconium ingots and castings. Other metals, such as hafnium, tantalum and columbium, may be included.

Since 1949 Wah Chang Corporation has been carrying out research on unusual metals. As a result, it decided to enter into agreement with the Federal government to operate the Bureau of Mines' zirconium pilot properties at Albany, Ore., and Boulder City, Nev. Under its contract with the A.E.C., Wah Chang will produce about 150 s.tons of high-purity sponge annually at the Albany plant for at least two years. In the event of increased demand, it will construct a larger plant of its own in the same area.

The London Metal Market

(From Our Metal Exchange Correspondent)

Business in general is still suffering from holidays in most parts of the world, and prices continued to drift until Tuesday when a slight recovery set in. The reason for this is somewhat obscure as there was an unaccountable change in sentiment, actual business remaining very much of a routine nature. The

week has seen a continuation of the minor strikes in Rhodesia, and there is still no news of the method the U.K. government is going to employ in disposing of its copper. Demand in the U.K. has remained just satisfactory, whilst in America things became quieter immediately the custom smelters reduced their price on Monday. There is once again a contango on copper, and this time it is expected to remain as there is no technical position like there was in July to militate against it.

There has been nothing outstanding in the tin market but demand in the U.S. is reported as better, and as forecast last week the Malayan tin strike has again been averted. On Thursday morning the Eastern price was equivalent to £787½ per ton c.i.f. Europe.

The lead and zinc market have shown very little movement with activity at a minimum, and this state of affairs is considered likely to continue although from statistics it would appear that the present zinc price is now too high. It is felt, however, that there will be no move to reduce the price until the U.S. galvanizing industry has become normal following settlement of the steel strike.

Closing prices and turnovers are given in the following table:

	August 16		August 23	
	Buyers	Sellers	Buyers	Sellers
Copper				
Cash	£297	£298	£298	£298½
Three months	£297	£298	£298	£299
Settlement		£298		£298½
Week's turnover		5,500 tons		6,750 tons
Tin				
Cash	£769	£770	£772	£774
Three months	£767	£768	£770	£771
Settlement		£770		£774
Week's turnover		400 tons		555 tons
Lead				
Current half month	£115½	£115½	£115	£115½
Three months	£113½	£114	£114	£114½
Week's turnover		3,550 tons		2,250 tons
Zinc				
Current half month	£95	£95½	£94½	£95
Three months	£93	£93½	£92½	£93½
Week's turnover		3,775 tons		2,750 tons

OTHER LONDON PRICES — AUGUST 23

METALS

Aluminium, 99.5%, £198 10s. per ton	Magnesium, 2s. 4d. lb.
Antimony —	Nickel, 99.5% (home trade) £519 per ton
English (99%) delivered, 10 cwt. and over £210 per ton	Osmium, £24/27 oz. nom.
Crude (70%) £200 per ton	Osmiridium, nom.
Ore (60%) bases 23s. 6d./24s. 6d. nom. per unit, c.i.f.	Palladium, £8 0s./£8 10s. oz.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Platinum U.K. and Empire Refined £34/£35 oz. Imported £37 15s. nom.
Cadmium 12s. 0d. lb.	Rhodium, £42.
Chromium, 6s. 11d. lb.	Ruthenium, £15/£17 oz.
Cobalt, 21s. lb.	Quicksilver, £83 10s. ex-warehouse
Gold, 251s. 6½d.	Selenium, 112s. nom. per lb.
Iridium, £29/31 oz.	Silver, 79d. f.o.z. spot and 79½d.
Manganese Metal (96%-98%) £259/£265 according to quantity	Tellurium, 15s./16s. lb.

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Bismuth	65% 8s. 6d. c.i.f.
Chrome Ore —	20% 3s. 3d. lb. c.i.f.
Rhodesian Metallurgical (semifriable) 48%	£16 15s. 0d. per ton c.i.f.
„ Hard Lumpy (45%)	£16 15s. 0d.
„ Refractory 40%	£10 15s. 0d. per ton c.i.f.
„ Smalls 42%	£13 15s. 0d. per ton c.i.f.
Baluchistan	£17 5s. 0d. c.i.f.
Magnesite, ground calcined ..	£28 0s./£30 0s. d/d
Magnesite, Raw (ground) ..	£21 0s./£22 0s. d/d
Molybdenite (85% basis) ..	8s. 2½d. nom. per lb. (f.o.b.)
Wolfram and Scheelite (65%)	246s. 0d./250s. 0d. c.i.f.
Tungsten Metal Powder ..	20s. 2d. nom. per lb. (home)
(98% Min. W.)	
Ferro-tungsten (80%-85%) ..	17s. 2d. nom. per lb. (home)
Carbide, 4-cwt. lots ..	£41 3s. 9d. d/d per per ton
Ferro-manganese, home ..	£66 per ton
Manganese Ore Indian Europe (46%-48%) basis 125s. freight ..	105d./106d. nom. per unit c.i.f.
Manganese Ore (43%-45%) ..	98d./99d. nom. per unit c.i.f.
Manganese Ore (38%-40%) ..	92d. nom. per unit.
Brass Wire	3s. 0d. per lb. basis
Brass Tubes, solid drawn ..	2s. 3½d. per lb. basis

sible for this were better news from Cyprus, hopes for a Suez settlement and a strong rally in gilts.

Some exceptional features appeared amongst mining issues. Foremost of these was Rho-Khats which rose from 38s. to 43s. 9d. in otherwise dull copper markets. News of the bauxite find in Australia hoisted Consolidated Zinc from 53s. to 57s. 3d. Hopes centering around Western Selection's Canadian operation raised these shares to 8s. 3d.

Important Bauxite Find in Australia

Reports have reached this country from Northern Queensland, Australia, that extremely large deposits of bauxite have been found at Weipa on the western coast of Cape York Peninsula. The Consolidated Zinc Corporation—which has authority to prospect the area—has stated that although much further testing and sampling is necessary before the full extent and grade could be determined, evidence to date showed several hundred million tons of bauxite in one section alone of the areas concerned. If grade came up to expectations it would be possible—and necessary—to contemplate major development in the production of alumina and metal based on Australian resources. The scale of operations would be commensurate with some of the largest projects under construction elsewhere in the world. Grades present in the deposits should be known by the end of the year.

Platinum Dividends

A dividend of 9d. per share, or 100 per cent, on its capital as recently increased by rights issue, has been declared by *Poigiersrust Platinums*. Previously an interim of 5d. per share, of 55 5/9ths per cent, had been paid on the old capital. In the preceding year distributions totalled 1s. per share, or 133 1/3 per cent. *Union Platinum Mining* is to pay a dividend of 1s. 2 1/4d. per 5s. share, or 24 1/2 per cent, on its larger capital. An interim of 8d., or 13 1/3 per cent, had previously been paid in respect of the current financial year ending August 31, 1956. During the previous 14 months from August 31, 1955, dividends totalled 2s. 4 1/4d. per share or 47 1/2 per cent. A dividend of 1s. 3 1/4d. per share on its increased capital, or 51 1/3 per cent, has been announced by *Watervaal (Rustenburg) Platinum Mining* in respect of the year ending August 31, 1956. An interim of 8 1/2d. per 2s. 6d. share, or 28 1/2 per cent, was paid prior to the rights issue last April. Total payments for 14 months ended August 31, 1955, was 2s. 7d. per share, or 103 1/3 per cent.

Mount Morgan Pays 10 Per Cent Final

A final dividend of 10 per cent has been declared by Mount Morgan on its issued ordinary capital of £A1,400,000 in 10s. stock units. Total distribution for the year ended June 30, 1956, thus becomes 20 per cent. During the previous year an interim of 10 per cent was followed by a final of 10 per cent plus a bonus of 5 per cent making 25 per cent in all. Net profit for the past financial year was £581,533.

Directory of Directors 1956

Making its appearance in the seventy-seventh year of issue is the well-known Directory of Directors. This important reference book is published by Thomas Skinner and Company, 330 Gresham House, Old Broad Street, E.C.2, at a price of £2 10s. net, post free.

Besides listing directors of all public companies in the U.K., this volume gives similar information in respect of a large number of private concerns. Some 35,000 names appear in the publication and each director's various interests are listed individually under his name. For the first time an asterisk has been placed against members of the Institute of Directors.

Company Shorts

Gold Fields Expands to Australia.—Consolidated Gold Fields of South Africa's wholly-owned operating subsidiary—New Consolidated Gold Fields—is reported to have registered a new company in Australia with an authorized capital of £A1,000,000. The company's name will be New Consolidated Gold Fields (Australasia) and its objects will include exploration, development and the bringing to production of mining properties. Investment in existing operating mines will also be undertaken.

Kolar Gold Compensation.—The Mysore State Minister of Home Affairs, Mr. H. Siddaveerappa, has rejected charges by Kolar Goldfields mining companies that the compensation offer (amounting to some £900,000) for eventual nationalization was

unreasonably low. Mr. Siddaveerappa also rejected the companies' request to put their compensation claim before an independent tribunal.

Mazapil Pays 10 Per Cent.—Mazapil Copper Company has returned to the dividend list with a payment of 10 per cent on its issued ordinary capital of £600,000 in £1 stock. The last previous distribution was made in 1951 and totalled 7 1/2 per cent.

After all charges, including U.K. and foreign taxation, group profit for the year ended December 31, 1955, expanded to £115,278 from £38,587. The latter figure was struck after meeting an exchange loss of the Mexican peso. A transfer of £50,000 (same) was made to contingencies reserve, and the group balance carried forward moved up to £43,544 from £12,817.

Kinta Kellas Pays Ten Per Cent.—A dividend of 10 per cent has been declared by Kinta Kellas Tin Dredging Company for the year ended March 31, 1956. Previously, the last dividend to be paid was 20 per cent in respect of the year 1951-52.

During the past financial year net profit after tax rose sharply to £16,608 from £1,120. A sum of £20,000 (nil) was placed to general reserve and carry forward declined to £20,607 from £23,391. Mr. P. J. Burgess is chairman.

National Bank of India Maintains Interim.—The National Bank of India has declared an interim dividend for 1956 of 7 1/2 per cent. During the previous year the same payment was made followed by a further dividend of 7 1/2 per cent making 15 per cent for the year.

APPLICATIONS are invited for a managerial post in charge of prospecting operations and field work in a large area held under sole licence in the U.K. Geo-physical and Geochemical prospecting parties are out and trenching and diamond drilling is in progress. Applicants must have experience of this type of work, and also underground development. Salary up to £2,000 p.a., plus housing. Write Box W.538, c/o Streets, 110 Old Broad Street, E.C.2.

EXPLORATION GEOLOGISTS: Applications are invited from qualified single persons for geological exploration work in Western Uganda. 3-year contracts will be entered into with passages paid. A field allowance will be paid. Salary will be determined according to qualifications and experience. Apply giving full particulars of qualifications and previous experience, personal history, age, to General Manager, Kilembe Mines Ltd., P.O. Box 1, Kilembe, Uganda.

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Applications should be addressed to: The Appointments Officer, Anglo American Corporation of South Africa Limited, 40 Holborn Viaduct, London, E.C.1.

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